

WHAT IS CLAIMED IS:

1. A purified protein which specifically binds to
a gastro-intestinal tract receptor selected from the group
5 consisting of HPT1, hPEPT1, D2H, and hSI.
2. A protein which binds specifically to a
gastro-intestinal transport receptor selected from the group
consisting of HPT1, hPEPT1, D2H, and hSI, in which the
10 protein comprises an amino acid sequence selected from the
group consisting of SEQ ID NOS:1-55 or a binding portion
thereof.
3. A protein which binds specifically to a
15 gastro-intestinal transport receptor selected from the group
consisting of HPT1, hPEPT1, D2H, and hSI, in which the amino
acid sequence of the protein is selected from the group
consisting of SEQ ID NOS:1-55, or a binding portion thereof.
- 20 4. The protein of claim 2 which comprises the
amino acid sequence substantially as set forth in:
SEQ ID NO: 4, SEQ ID NO: 6, SEQ ID NO: 22, SEQ ID NO: 23, SEQ
ID NO: 30, SEQ ID NO: 43, SEQ ID NO: 46, or SEQ ID NO: 52, or
a binding portion thereof.
- 25 5. The protein of claim 3, the amino acid
sequence of which consists of the amino acid sequence
substantially as set forth in: SEQ ID NO: 4, SEQ ID NO: 6,
SEQ ID NO: 22, SEQ ID NO: 23, SEQ ID NO: 30, SEQ ID NO: 43,
30 SEQ ID NO: 46, or SEQ ID NO: 52, or a binding portion
thereof.
6. A protein of not more than 50 amino acids in
length which specifically binds to a gastro-intestinal
35 transport receptor selected from the group consisting of
HPT1, hPEPT1, D2H, and hSI, in which the protein includes,
positioned anywhere along its sequence, the contiguous amino

acid sequence of: Xaa₁ Thr Xaa₂ Xaa₃ Ser Xaa₄ Xaa₅ Xaa₆ Asn Xaa, Arg (SEQ ID NO:253), where Xaa₁ is Ser or Thr; Xaa₂ is Arg or Lys; Xaa₃ is Lys or Arg; Xaa₄ is Ser or Leu; Xaa₅ is Arg, Ile, Val, or Ser; Xaa₆ is Ser, Tyr, Phe, or His; and Xaa,
5 is Pro, His or Arg.

7. The protein of claim 6 which is not more than 40 amino acids in length.

10 8. The protein of claim 6 which is not more than 30 amino acids in length.

9. The protein of claim 6 which is not more than 20 amino acids in length.

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10. A protein of not more than 50 amino acids in length which specifically binds to a gastro-intestinal transport receptor selected from the group consisting of HPT1, hPEPT1, D2H, and hSI, in which the protein includes, 20 positioned anywhere along its sequence, the contiguous amino acid sequence of: Asp Xaa₁ Asp Xaa₂ Arg Arg Xaa₃ Xaa₄ (SEQ ID NO:254) where Xaa₁ is Ser, Ala, or Gly; Xaa₂ is Val or Gln; Xaa₃ is Pro, Gly, or Ser; and Xaa₄ is Trp or Tyr.

25 11. The protein of claim 10 which is not more than 40 amino acids in length.

12. The protein of claim 10 which is not more than 30 amino acids in length.

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13. The protein of claim 10 which is not more than 20 amino acids in length.

14. A protein of not more than 50 amino acids in 35 length which specifically binds to a gastro-intestinal transport receptor selected from the group consisting of HPT1, hPEPT1, D2H, and hSI, in which the protein includes,

positioned anywhere along its sequence, the contiguous amino acid sequence of: Val Arg Ser Gly Cys Gly Xaa₁ Xaa₂ Ser Ser (SEQ ID NO:255), where Xaa₁ is Ala or Phe; and Xaa₂ is Arg or His.

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15. The protein of claim 14 which is not more than 40 amino acids in length.

16. The protein of claim 14 which is not more than 10 30 amino acids in length.

17. The protein of claim 14 which is not more than 20 amino acids in length.

15 18. A protein of not more than 50 amino acids in length which specifically binds to a gastro-intestinal transport receptor selected from the group consisting of HPT1, hPEPT1, D2H, and hSI, in which the protein includes, positioned anywhere along its sequence, the contiguous amino acid sequence of: NTRKSSRSNPR (SEQ ID NO:256) or STKRSLIYNHR (SEQ ID NO:257) or STGRKVFNRR (SEQ ID NO:258) or TNAKHSSHNR (SEQ ID NO:259).

19. A protein of not more than 50 amino acids in 25 length which specifically binds to a gastro-intestinal transport receptor selected from the group consisting of HPT1, hPEPT1, D2H, and hSI, in which the protein includes, positioned anywhere along its sequence, the contiguous amino acid sequence of: DSDVRRPW (SEQ ID NO:260) or AADQRRGW (SEQ 30 ID NO:261) or DGRGGRSY (SEQ ID NO:262).

20. A protein of not more than 50 amino acids in length which specifically binds to a gastro-intestinal transport receptor selected from the group consisting of 35 HPT1, hPEPT1, D2H, and hSI, in which the protein includes, positioned anywhere along its sequence, the contiguous amino

acid sequence of: RVRS (SEQ ID NO:263) or SVRSGCGFRGSS (SEQ ID NO:264) or SVRGCGAHSS (SEQ ID NO:265).

21. The protein of claim 1, 2, 3, 6, 10, 14, 18, 5 19, or 20 which is purified.

Sub B1
22. A composition comprising the protein of claim 1, 2, 3, 6, 10, 14, 18, 19, or 20, bound to a material comprising an active agent, said active agent being of value 10 in the treatment of a mammalian disease or disorder.

23. The composition of claim 22 in which the active agent is a drug.

15 24. The composition of claim 22 in which the material is a particle containing the active agent.

25 20 26. The composition of claim 22 in which the material is a slow-release device containing the drug.

27. The composition of claim 22 in which the protein is covalently or noncovalently bound to the material.

Sub B2
25 20 27. A composition comprising a chimeric protein bound to a material comprising an active agent, in which the chimeric protein comprises a sequence selected from the group consisting of SEQ ID NOS:1-55 or a binding portion thereof fused via a covalent bond to an amino acid sequence of a second protein, in which the active agent is of value in the 30 treatment of a mammalian disease or disorder.

28. A composition comprising the protein of claim 1, 2, 3, 6, 10, 14, 18, 19, or 20 covalently bound to a particle containing a drug.

35 29. A composition comprising the protein of claim 1, 2, 3, 6, 10, 14, 18, 19, or 20 covalently bound to a drug.

30. The composition of claim 22 which facilitates the transport of the active agent through human or animal gastro-intestinal tissue.

5 31. A method of delivering an active agent *in vivo* comprising administering to a subject a purified composition of claim 22.

10 32. A method of delivering a drug to a subject comprising administering to the subject a purified composition of claim 30.

15 33. A method of delivering a drug to a subject comprising administering to the subject a purified composition of claim 31.

34. The method according to claim 31 in which the administering is oral.

20 35. The method according to claim 31 in which the active agent is a drug.

36. The method according to claim 31 in which the subject is a human.

25 37. The method according to claim 35 in which the subject is a human.

38. The method according to claim 31 in which said composition facilitates the transport of the active agent through human or animal gastro-intestinal tissue.

39. The method according to claim 33 in which the administering is oral.

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40. A pharmaceutical composition comprising the composition of claim 22 in a pharmaceutically acceptable carrier suitable for use in humans *in vivo*.

5 41. A chimeric protein comprising at least 6 contiguous amino acids of an amino acid sequence selected from the group consisting of SEQ ID NOS:1-55, that specifically bind to a gastro-intestinal tract receptor, fused via a covalent bond to an amino acid sequence of a
10 second protein.

42. An antibody which is capable of immunospecifically binding the protein of claim 2, 3, 6, 10,
14, 18, 19 or 20.

15 43. A molecule comprising a fragment of the antibody of claim 42, which fragment is capable of immunospecifically binding said protein.

20 44. A purified derivative of the protein of claim 1 or 2, which displays one or more functional activities of said protein.

45. The derivative of claim 44 which is able to be
25 bound by an antibody directed against said protein.

46. A fragment of the protein of claim 2 comprising a domain of said protein.

30 47. A fragment of the protein of claim 3 comprising a domain of said protein.

35 48. A nucleic acid comprising a nucleotide sequence selected from the group consisting of SEQ ID NOS:110-163.

49. A nucleic acid comprising a nucleotide sequence selected from the group consisting of SEQ ID NOS:55-109.

5 50. An isolated nucleic acid comprising a nucleotide sequence encoding the protein of claim 1.

51. A nucleic acid comprising a nucleotide sequence encoding the protein of claim 2, 3, 6, 10, 14, 18,
10 19 or 20.

52. The nucleic acid of claim 51 which is a DNA.

53. The nucleic acid of claim 48 or 49 which is
15 isolated.

54. The nucleic acid of claim 51 which is
isolated.

20 55. An isolated nucleic acid comprising a nucleotide sequence complementary to the nucleotide sequence of claim 57.

25 56. An isolated nucleic acid comprising a nucleotide sequence encoding a fragment of the protein of
claim 1, 2, or 3, which fragments bind to said gastro-
intestinal tract receptor.

30 57. A nucleic acid comprising a nucleotide sequence encoding the chimeric protein of claim 41.

58. A nucleic acid comprising a nucleotide sequence encoding the fragment of claim 47.

35 59. The nucleic acid of claim 57 which is
isolated.

60. The nucleic acid of claim 58 which is isolated.

61. A recombinant cell containing the nucleic acid 5 of claim 48, 49 or 50.

62. A recombinant cell containing the nucleic acid of claim 51.

10 63. A recombinant cell containing the nucleic acid of claim 57.

64. A method of producing a protein comprising growing a recombinant cell containing the nucleic acid of 15 claim 48, 49 or 50 such that the encoded protein is expressed by the cell, and recovering the expressed protein.

65. A method of producing a protein comprising growing a recombinant cell containing the nucleic acid of 20 claim 51 such that the encoded protein is expressed by the cell, and recovering the expressed protein.

66. A method of producing a protein comprising growing a recombinant cell containing the nucleic acid of 25 claim 57 such that the encoded protein is expressed by the cell, and recovering the expressed protein.

67. The product of the process of claim 64.

30 68. The product of the process of claim 65.

69. The product of the process of claim 66.

35 *Sab B3* 70. A pharmaceutical composition comprising a therapeutically effective amount of a composition comprising the protein of claim 1, 2, 3, 6, 10, 14, 18, 19, or 20; and a pharmaceutically acceptable carrier.

71. The chimeric protein of claim 41 in which said second protein is a drug.

72. A nucleic acid comprising a nucleotide sequence encoding the protein of claim 71.

Sub B4
73. A pharmaceutical composition comprising a therapeutically effective amount of the protein of claim 71, and a pharmaceutically acceptable carrier.

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74. A pharmaceutical composition comprising a therapeutically effective amount of the nucleic acid of claim 78.

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75. A method of delivering a drug to a subject comprising administering to the subject a therapeutically effective amount of the pharmaceutical composition of claim 80.

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76. A method of treating or preventing a disease or disorder comprising administering to a subject in which such treatment or prevention is desired a therapeutically effective amount of the composition of claim 23.

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77. A method of treating or preventing a disease or disorder comprising administering to a subject in which such treatment or prevention is desired a therapeutically effective amount of the composition of claim 28.

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78. A method of treating or preventing a disease or disorder comprising administering to a subject in which such treatment or prevention is desired a therapeutically effective amount of the composition of claim 29.

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79. The method according to claim 76 in which the disease or disorder is selected from the group consisting of:

hypertension, diabetes, osteoporosis, hemophilia, anemia, cancer, migraines, and angina pectoris.

80. The method according to claim 76 in which the subject is a human.

sub B's
81. A composition comprising the protein of claim 1, 2, 3, 6, 10, 14, 18, 19, 20, or 46 wherein the protein is coated onto or absorbed onto or covalently bonded to the surface of a nano- or microparticle.

82. A nano- or microparticle formed from the protein of claim 1, 2, 3, 6, 10, 14, 18, 19, 20, or 46.

15 83. The composition of claim 87, wherein the nano- or microparticle is a drug-loaded or drug-encapsulating nano- or microparticle.

20 84. A method of detecting or measuring the level of a gastro-intestinal tract receptor in a sample, comprising contacting a sample suspected of containing a gastro- intestinal tract receptor with the protein of claim 1, 2, 3, 6, 10, 14, 18, 19, 20, or 46 under conditions conducive to binding between the protein and any of said receptor in said 25 sample, and detecting or measuring any of said binding that occurs, in which the detected or measured amount of binding indicates the presence or amount of the receptor in the sample.

30 85. A method of identifying a molecule that specifically binds to a ligand selected from the group consisting of the protein of claim 1, 2, 3, 6, 10, 14, 18, or 19, a fragment of said protein comprising a domain of the protein, and a nucleic acid encoding said protein or 35 fragment, comprising

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(a) contacting said ligand with a plurality of molecules under conditions conducive to binding between said ligand and the molecules; and

(b) identifying a molecule within said plurality 5 that specifically binds to said ligand.

86. An isolated nucleic acid encoding a fragment of a gastro-intestinal tract receptor selected from the group consisting of HPT1, hPEPT1, D2H, and hSI, or encoding a 10 chimeric protein comprising said fragment, said fragment consisting essentially of the extracellular domain of the receptor.

87. A cell containing and capable of expressing a 15 recombinant nucleic acid encoding a fragment of a gastro-intestinal tract receptor selected from the group consisting of HPT1, hPEPT1, D2H, and hSI, or encoding a chimeric protein comprising said fragment, said fragment consisting essentially of the extracellular domain of the receptor.

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88. The cell of claim 87 which contains an expression vector comprising a nucleotide sequence encoding said fragment operably linked to a heterologous promoter.

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89. A method for identifying a molecule that specifically binds to a gastro-intestinal tract receptor comprising contacting a fragment of the receptor, or a chimeric protein comprising said fragment, with a plurality of test molecules under conditions conducive to binding 30 between said fragment or protein and the molecules, and identifying a molecule within said plurality that specifically binds to said fragment or protein, in which the fragments consist essentially of the extracellular domain of the receptor.

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90. The composition of claim 22 for use as a medicament.

91. The composition of claim 28 for use as a medicament.

92. The composition of claim 29 for use as a
5 medicament.

93. The composition of claim 81 for use as a medicament.

10 94. The composition of claim 23 in which the drug is insulin or leuprolide.

95. The composition of claim 24 in which the active agent is insulin or leuprolide.

15 96. The composition of claim 25 in which the drug is insulin or leuprolide.

97. The composition of claim 28 in which the drug
20 is insulin or leuprolide.

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